MODELLING OF THE SYSTEM OF MAGNETIC ANISOTROPIC NANOPARTICLES

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The latest technologies of creating smart materials allow to achieve a completely new level due to a variety of factors, such as the development of synthesis of new composite polymer materials with controlled properties and the creation of new magnetic nanoparticles with the form's anisometry [1] and anisotropic internal structure [2]. The thermodynamic properties of such systems are controlled both by external factors (temperature, electric and magnetic fields) and by the parameters of their microstructural units (shape, structure, topology).

This work presents a comprehensive study of the system of magnetic ellipsoidal nanoparticles, which allows to reveal the effect of anisotropy of the particle shape on microstructure and macroscopic properties. Ellipsoidal nanoparticles have a strong interparticle dipole-dipole interaction. In this investigation we directed the magnetic moments of anisotropic nanoparticles parallel/perpendicular to the main axis of rotation. We use molecular dynamics to perform computer simulations.

Also we studied the system of magnetic filaments with different topologies composed of ferromagnetic ellipsoidal nanoparticles. We focused on simple open chains and closed rings, which are the ground states of dipole spherical particles [3,4]. Firstly, we calculate the total dipole moment of the filament chain made of N identical particles with the value of dipole moment μ. Then we calculate the radius of gyration and observe filaments' behavior under different parameters.

Hence, we investigated the effect of anisotropy of nanoparticle shape on microstructure and macroscopic properties of magnetic soft materials with anisotropic particles. The particles' anisotropy is very important and has an influence on many parameters. These results provide recommendations for the development of new systems with magnetic response that can become quite useful in further applications, where the most important one is medicine.

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